

To: Wagener, Christine[wagener.christine@epa.gov]
From: john.coleman
Sent: Thur 5/21/2015 7:05:42 PM
Subject: Fwd: 2 additional figures re: Wild Rice technical call
[logi.hist.presence-sulfide1.JPG](#)
[logi.hist.example1.JPG](#)

christine,

Here is the material I circulated prior to the meeting with PCA on the 20th.
john

----- Forwarded Message -----

Subject: 2 additional figures re: Wild Rice technical call

Date: Wed, 20 May 2015 12:35:08 -0500

From: john.coleman <jcoleman@glifwc.org>

Ex. 6 - Personal Privacy

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attached are two additional figures related to logistic regression of the field data. They may or may not get discussed today but I wanted folks to have them in case we discussed.

The first is a stacked histogram of the field data for rice presence (defined as > 2 stems/sq-m) and sulfide concentration. The histogram of frequency of sites with rice absent is along the bottom of the graph. The histogram of the frequency of sites with rice present is hanging down from the top of the graph.

The red line is the logistic regression that is used to predict the probability of presence vs. absence. From it, one can predict the probability of rice presence for different concentrations of sulfide. The red line is approximately the logistic regression presented in many of PCA's documents, although this one is not plotted on a log x scale.

Of note in this figure is that the histograms of sites with rice absent (presence = 0) is very similar to the histogram of the sites with rice present (presence = 1). The primary difference between the histograms is that the rice-absent distribution has a longer tail (i.e. there are more rice-absent sites with high sulfide concentrations).

The second figure is an example of what one would hope to have when doing logistic regression, clearly distinguishable distributions.

john

john.coleman wrote on 5/19/2015 3:50 PM:

In preparation for the discussion on Wednesday I wanted to provide some very preliminary examination of field data on rice density and sediment sulfide concentrations. Suggestions for further exploration or corrections to this analysis would be appreciated.

john

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Sulfide concentration & Rice Density. Theoretical vs. observed relationship

The current proposal seems to assume that at high sulfide concentrations (i.e. above 165 ug/L) sulfide has a large effect on whether rice is "present" as defined by the MPCA (i.e. rice density above 2 stems/sq-m). At low concentrations (i.e. below 165 ug/L) sulfide is proposed to have at most a 10% negative effect on whether rice is present.

The general relationship between rice health and sulfide concentration proposed by the PCA is shown as the solid blue line below:

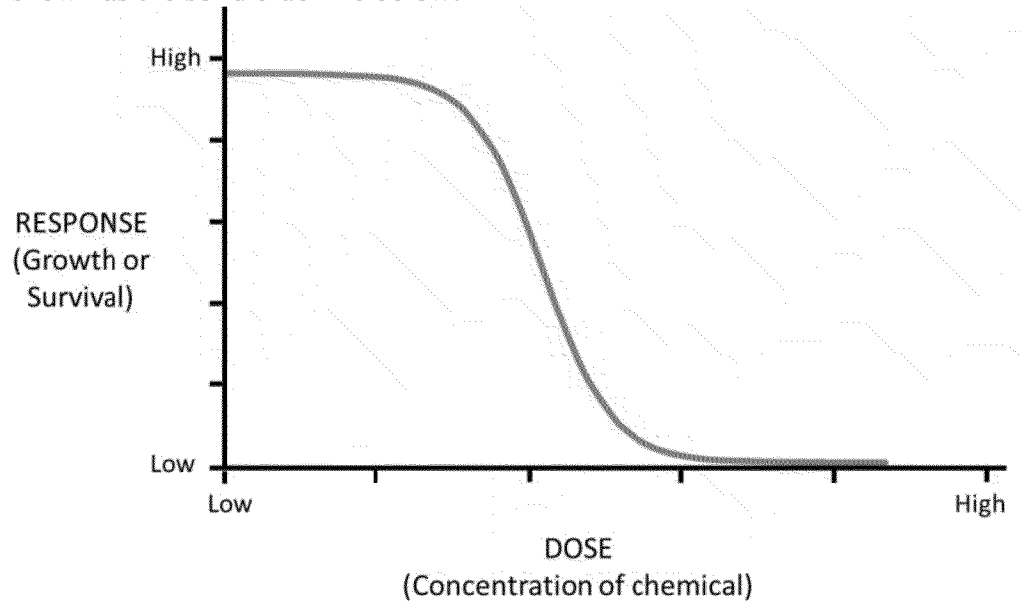
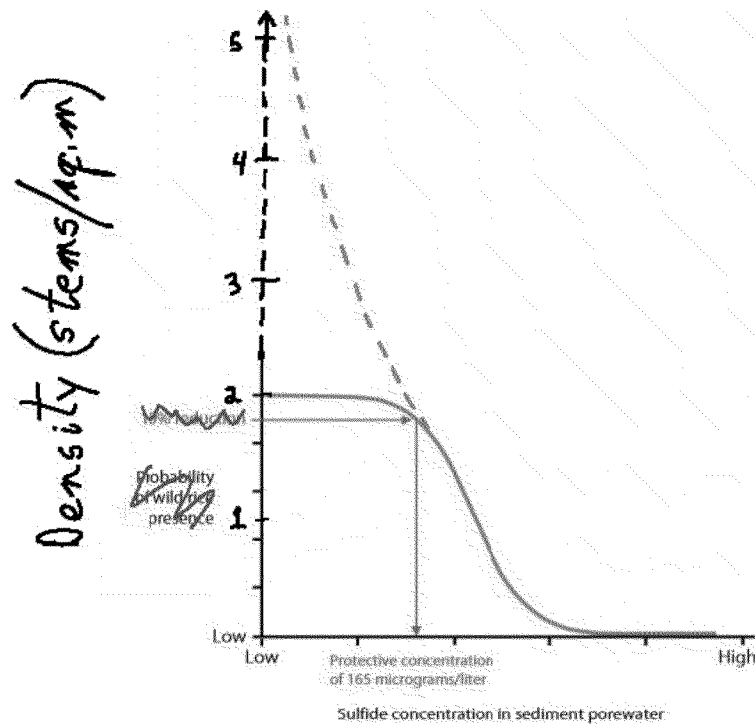


Fig. 1 (from wq-s6-43l.pdf)

Which suggests that at low to moderate levels, sulfide has little to no impact on growth or survival.

However, the relationship might be something like this:

Fig.

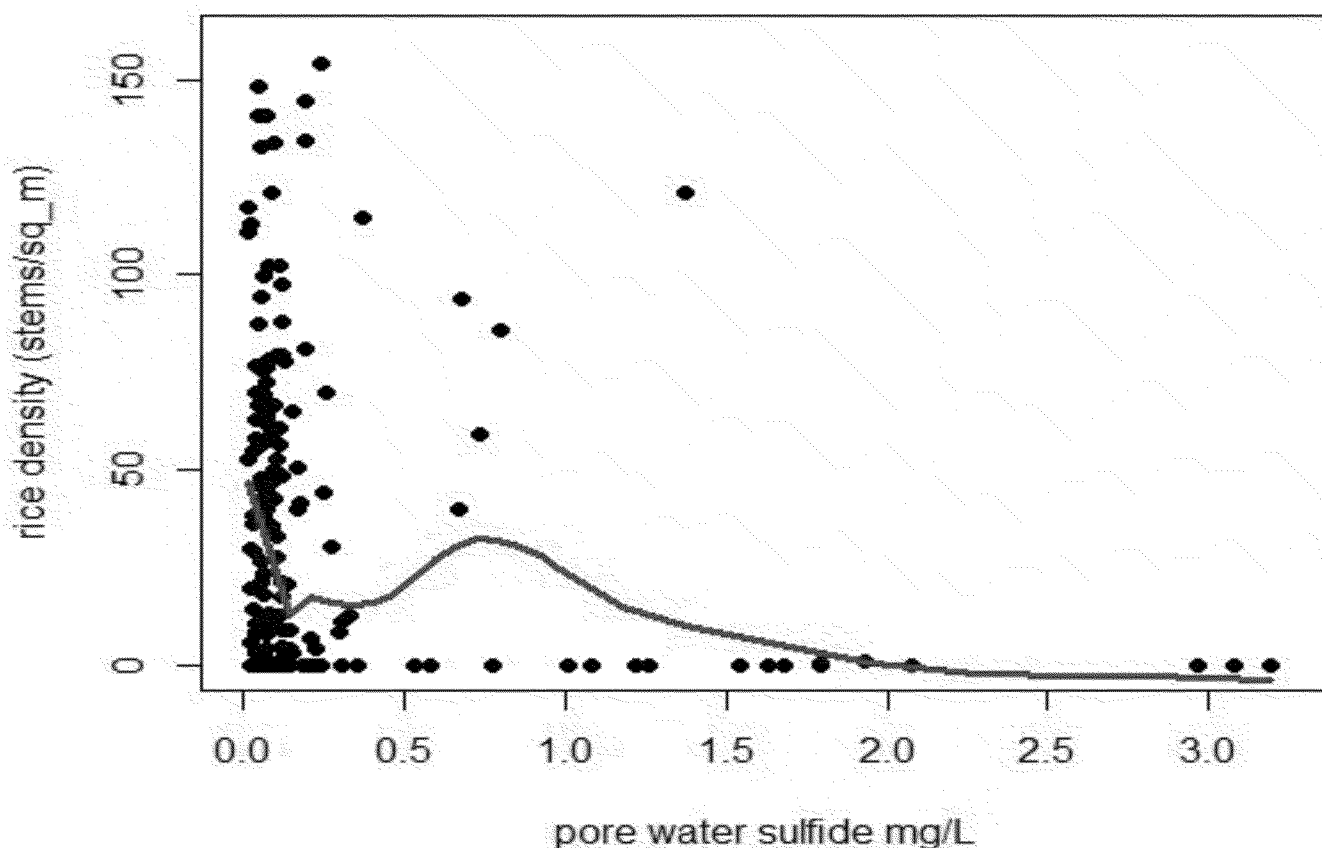


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Which suggests that at concentrations below 165 ug/L sulfide has substantial effect on rice health, as indicated by stem density.

The field data of sulfide concentration and rice density (with LOESS trend line) looks like this:

Fig. 3



(note: a very high value of sulfide (16 mg/L) and a very high density of rice (252 stems/sq-m), have been excluded so that data in the mid and low range can be seen.)

Frequency of zero rice density

One can see from Fig. 3 that at high sulfide concentrations (i.e. > 1 mg/L) rice density is almost always zero. The problematic part is that even at low sulfide concentrations (i.e. < 1 mg/L) rice density is still most often zero (i.e. mode is 0). For example, if one only looks at samples where sediment sulfide was < 0.165 mg/L, rice density is most often zero (Table 1).

Table 1. Frequency table of rice density and sulfide concentration.

	Sulfide concentration group (mg/L)	
rice density group (stems/sq-m)	0 to 0.165	0.165 to 3.1
[0,0]	42	26
(0.1,2]	5	2
(2,10]	16	3

(10,50]	37	6
(50,100]	33	6
(100,260]	11	6

What is evident from the field data is that many sites were observed to have zero(0) density and many sites were observed to have very low sulfide. At high sulfide concentrations rice density is almost always zero. However, a large number of zero density sites were also very low sulfide sites. This leads to a question as to what all these zero rice densities mean. Are they due to sulfide or something else?

Trend in rice density at lower sulfate concentrations

Looking in more detail at rice density when sulfide concentration is between 0 and 0.5 mg/L we see that there seems to be decreasing rice density as sulfide increases above zero.

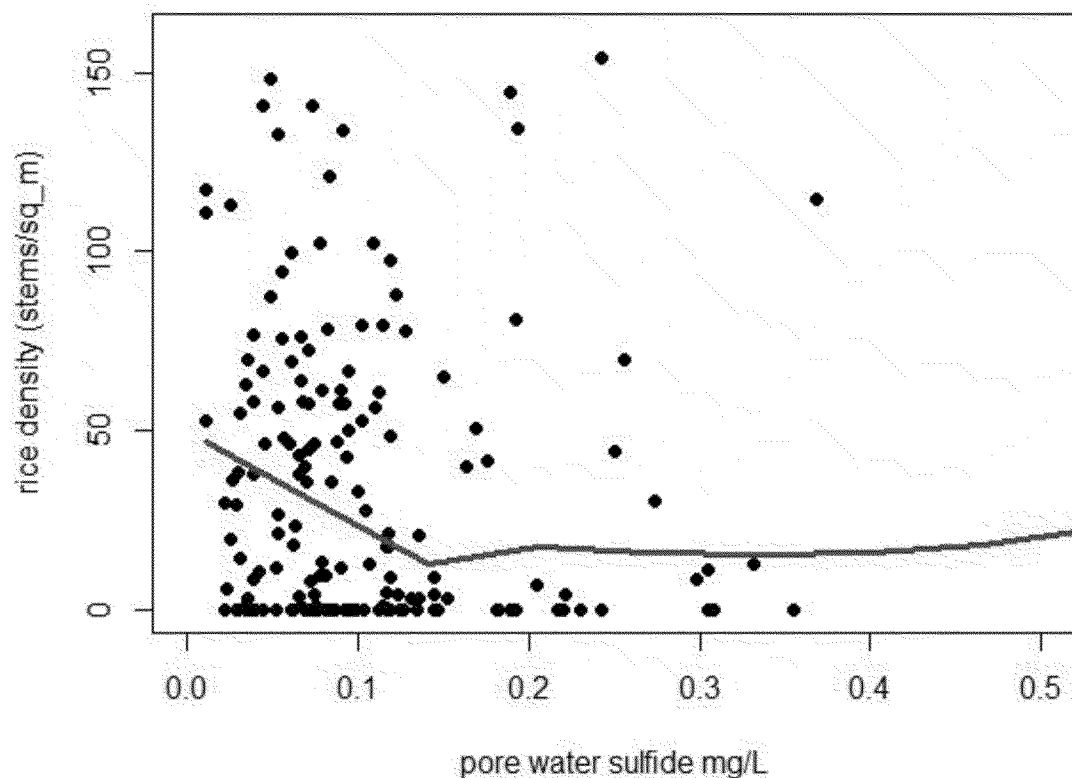


Fig. 4. A graph (with LOESS trend line) of rice density over the range of sulfide concentration of 0 to 0.5 mg/L (i.e. limiting the x-axis to 0 to 0.5 mg/L)

It appears from this graph that rice density may be highest at the very lowest concentrations of sulfide.

Limiting analysis to sulfide concentrations below 0.165 mg/L shows a decreasing trend in rice density as sulfide increases (Fig. 5). It appears that rice density decreases substantially

from an average of about 50 stems/sq-m to an average of about 20 stems/sq-m, as sulfide levels climb from near zero to 0.165 mg/L.

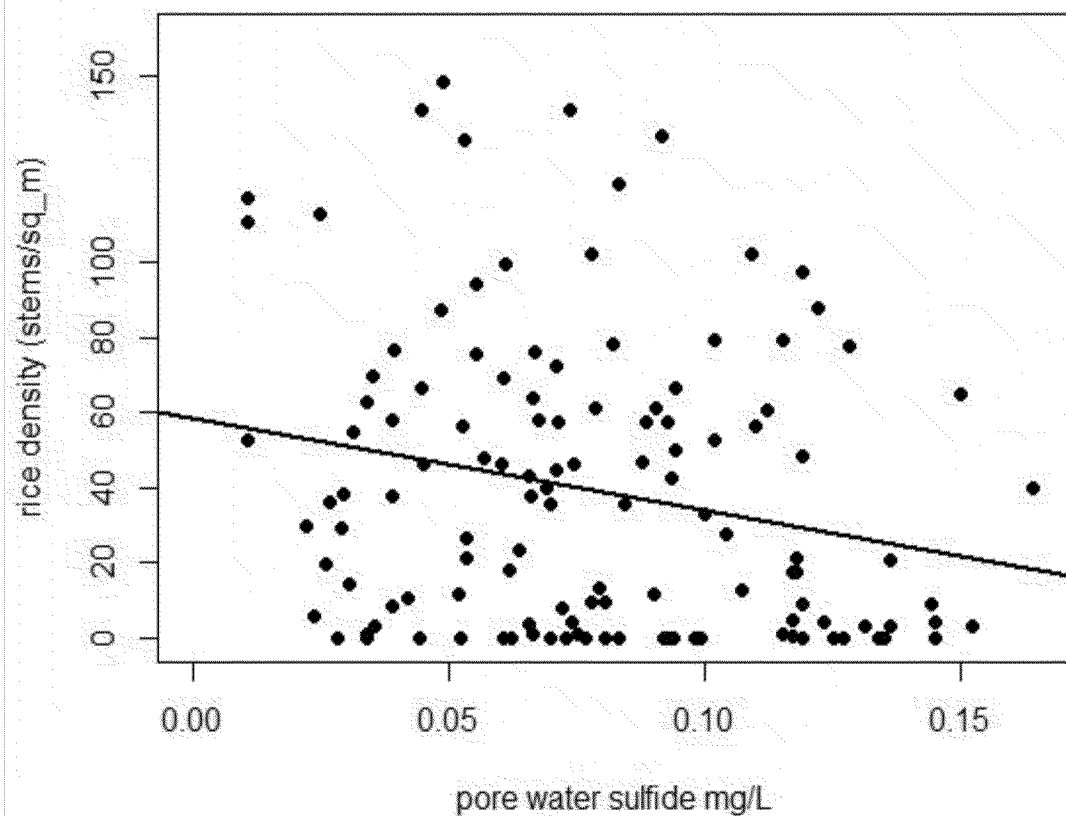
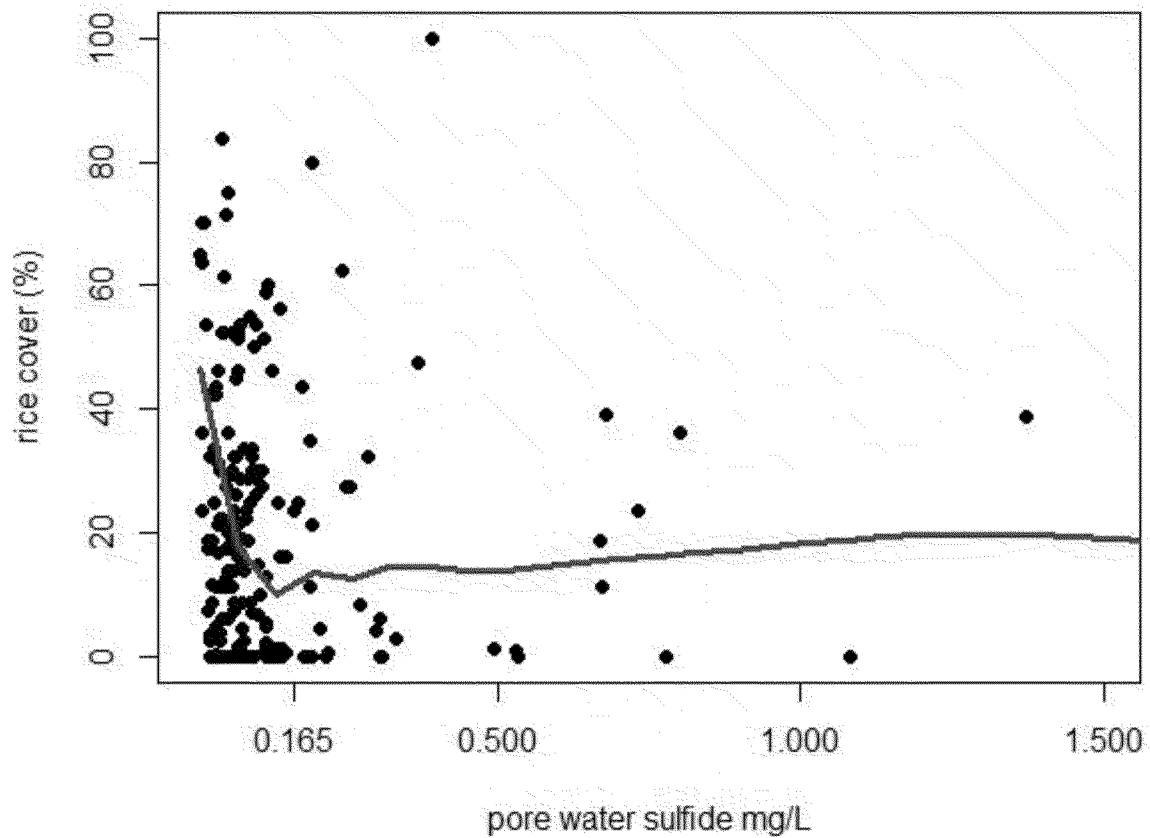


Fig. 5

Rice percent cover vs. sulfide concentration

Additional analysis of sediment sulfide concentration vs. percent rice cover shows a similar trend: decreasing average rice cover as sulfide concentrations increase from around zero to 0.165.

Fig.



6

Preliminary conclusions:

- 1) The field data have a lot of zero rice densities both at low and at high sulfide concentrations. A record of zero density could be interpreted in several ways. These zero densities drive the statistical relationship between sulfide and density.
- 2) There is a decreasing trend in rice density and rice cover when sulfide concentrations increase from near 0 to 0.165 mg/L